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THE PLAGUE AT OPORTO.

BY DR. ALBERT CALMETTE, DIRECTOR OF THE LILLE PASTEUR INSTITUTE.

DURING the past hundred and fifty years, Europe has been accustomed to regard the plague as a disease that might be expected to rest confined to the extreme eastern part of the Old World. Since the famous epidemic at Marseilles in 1720, the disease has made but rare incursions on European soil. Except for several epidemics, of a limited nature, confined to the borders of the Caspian Sea, European Turkey and the Balkan Peninsula, the plague has ceased visiting the large seaports of the Adriatic, the Mediterranean and the Atlantic, where, for the three hundred years before the eighteenth century, it had made no inconsiderable ravages.

The recent appearance of this malady at Oporto has justly disturbed Europe; for one now perceives that the plague, contrary to what has hitherto been believed, is not incompatible with the progress of civilization and modern hygiene. An inquiry, as circumstantial as possible, has been made regarding the causes of the importation of the plague at Oporto; but it has been impossible to discover the source of infection.

Two hypotheses, equally plausible, have been advanced. According to one, the disease had spread among the small rodents, rats and mice, at Oporto, long before the first case of the plague had been reported. Since the recent investigations of Dr. Yersin and Dr. Simond in India, it is admitted, in fact, that rats and mice are most susceptible to the plague virus, and that in localities where this pestilence appears they succumb in great numbers.

Generally, the mortality among the small rodents precedes the appearance of the disease among human beings. This fact is well known to the natives of certain valleys of the Himalayas, who, when they perceive the rats and mice dying in large numbers, abandon their villages to prevent the spreading of the disease in their homes. It would not be surprising if the plague virus had been brought to Oporto, several months before the outbreak, by the rats disembarked from a ship coming from Alexandria or India. The inhabitants of the quarter bordering on the Douro remarked, indeed, that the streets were overrun by swarms of rodents, and that the dead bodies of these animals were often found in the streams of the town.

The other hypothesis holds to the opinion that the plague was brought to Oporto by an English ship, the "City of Cork," coming from London, and making regular voyages between London and Oporto. On several occasions during the months of May and June, this ship unloaded Asiatic merchandise on the wharf of Oporto, especially rice from Rangoon and Burmah, tea from China and India, tapioca and cinnamon bark from Ceylon, and fibres from Bombay, Calcutta and the Island of Mauritius. This much is certain, that the earliest cases of the plague coincided with each unloading of this cargo, and those first stricken down were the men employed in discharging the cargo and the women who repaired the sacks used for unloading the grain.

One may well be surprised that this merchandise, as it came from London, had not infected the capital of the United Kingdom; but, on the other hand, it is quite possible that a ship on a direct or indirect course from India might have brought to the wharf of Oporto rats infected with the virus or contaminated clothing.

To satisfy oneself on this point, it need only be remembered that in 1896 two Portuguese cooks, who arrived by ship at London on September 27th, succumbed to the plague the following 3d of October at the Marine Hospital in that city; the ship which brought them having left Bombay on the 21st of the preceding August, and no other persons on the ship, either during the voyage or after landing, having been attacked by the disease. These cooks had taken no part in the unloading of the vessel, but they had brought in their boxes toilet articles, silk handkerchiefs, etc., bought at Bombay; from the London docks these were carried away in their trunks, and it was these articles which were evidently infected. The virulence of the plague-microbe evidently lasted for more than a month. One must then admit the reasonableness of the hypothesis of the indirect importation of the plague to Oporto by London.

The first properly proven cases appeared on the 5th of June, but the presence of the disease was not officially confirmed until the 13th of August. This long delay cannot be attributed to the neglect of the medical staff or of the Portuguese Government, for the diagnosis of the plague presents great difficulties, and, on the other hand, the importance of the question was such that the doctors were obliged to protect themselves by the most precise scientific tests before officially affirming to the authorities at Lisbon the true nature of the disease.

As I have just stated, the first cases of plague appeared among the unloaders and porters living in the squalid quarter on the right side of the Douro, near the Exchange. This district is composed of narrow lanes, from ninety centimetres* to one and a half metres† wide, in flights of steps, with houses of two or three stories high, in a notoriously insanitary condition. Each of these houses contained several families, and often a number of persons lived huddled together in the same room. In many cases the ground floor was occupied by both shops and stables, where human beings swarmed amidst pigs, goats and all kinds of animals.

This district was unprovided with sewers. Here and there one met with cesspools choked with refuse that had accumulated for centuries. Of course, these cesspools were infested by legions of rats, from which it was impossible to clear them completely.

The first three cases appeared in the Rue Ronte Taurina. This lane directly communicated with the harbor, and the epidemic was not long in spreading to the neighboring houses and streets. During June, July and August the cases were relatively few, not more than five or six a week being reported; but in reality there was a large number of cases of illness and of deaths not reported in the official statistics; many families concealed their sick to prevent the obligatory transportation to the hospital; and hardly any of the fatal cases had been visited by a physician. From the inquiry that I made on the spot, I estimate the true number of cases at this period as being at least three times as many as were declared.

On the other hand, the season of the greatest heat was not favorable to the propagation of the epidemic; but, when the wet weather of mid-September arrived, the disease made great progress, and as many as four to six cases were then reported daily.

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* .9842 of a yard.

† 1.6204 yards.

When the first cases of the plague were discovered, the Portuguese authorities commenced by ordering the isolation of the town by means of a sanitary cordon of troops. In the beginning of September, when the French Scientific Mission arrived at Oporto, we found the town absolutely deprived of all communication with the outer world; it was almost impossible to supply the place with fresh provisions, and the price of food had largely increased; all shops were closed, the streets deserted, and Oporto had the aspect of a city in mourning. More than forty thousand laborers were without work, the factories having closed their doors.

All the foreign doctors present agreed with us that this isolation was more dangerous than useful, and that the famine that would result among the people would certainly do more to propagate the plague than to restrict it.

We advised the Portuguese Government to abandon this antiquated method. Our advice was but partially followed; the Government decided to permit the entrance of necessary provisions and the departure of travellers from one of the stations in the town under the restriction that luggage should be disinfected, and that passengers and their goods going to any other town in Portugal should submit to sanitary surveillance for nine days after their arrival. Our previsions were entirely realized. The sanitary cordon neither diminished the intensity of the epidemic nor prevented it from spreading, since several places outside the cordon were attacked by the scourge.

Measures of isolation, such as those undertaken by the Portuguese Government, could not be efficacious in a densely populated country; they are admissible in certain localities, of Eastern Russia, for example, where the population is thinly distributed and where there exist large territories without inhabitants. But in an European city isolation by a cordon of troops is entirely useless, since the inhabitants are dependent on the surrounding country for subsistence. On the other hand, it is practically certain that the soldiers employed for the sanitary cordon will be infected and that the cordon itself will become a means for propagating the disease outside.

At the time when the French Scientific Mission was sent to

Oporto by the Pasteur Institute, the nature and exact virulence of the disease were not entirely decided; it was necessary to determine with exactitude if the microbe was identical with that studied by Yersin in India, and if, following the inception of the virus in the European race, its characteristics had not changed. It was also urgently necessary to take account of the value of the prophylactic and therapeutic means which the studies of the past three years of the Pasteur Institute had suggested for the defense of Europe against the plague.

We commenced, then, by investigating, by means of experiments on animals susceptible to the plague, the degree of virulence presented by the microbe at Oporto compared with that of India, and we were not long in deciding that the Oporto microbe was extremely virulent, even more so than the one isolated at Bombay. Although the cases among human beings were not numerous, the disease presented characteristics the gravity of which in nearly all cases was disquieting. It was very often a case of pestilent pneumonia, which, from the studies made in India by English and French doctors, seems to be almost always fatal. The disease appeared with variable characteristics, and we were enabled to observe all forms of plague which had hitherto been described by various authors during the course of serious preceding epidemics.

The most common form is incontestably the traditional bubonic plague, which reveals itself by the appearance of tumors, that is to say, by large glands in the groin and in the armpits, or in the neck on each side of the jaw. The appearance of these glands is accompanied by high fever, headache and lumbago; those stricken are seized by a sort of mad fright, which sometimes leads them to escape from their homes when the pain does not oblige them to take to their beds at once. In slight cases, the glands remain highly swollen for eight or ten days; then they discharge, forming one or many abscesses more or less large; the fever goes down, and the normal condition returns. In more severe cases the glands are extremely painful; about the second or third day the body is covered with small red spots and then by pustules and a black tumor analogous to malignant pustules or anthrax. These cases are nearly always fatal. At other times, the patient is suddenly seized with intense fever, difficulty in breathing, spitting of blood; and it is then the pestilent pneumonia which develops, without any of the surface glands to permit the true nature of the disease to be suspected; it is a case, I repeat, of pestilent pneumonia, the diagnosis of which can only be made by an examination of the expectorations under the microscope, and it generally proves fatal in three to five days. In other very rare cases the plague takes an internal form strongly resembling typhoid fever; this kind is also mortal—at least without the intervention of serotherapic methods during the first days of its appearance.

The average mortality at Oporto was less than during the epidemics in India; up to the first of September about forty deaths were recorded for every hundred persons stricken; thereafter, thanks to the serotherapic treatment which was generally employed, at least in the plague hospital, the mortality fell to twelve per cent. These figures are naturally most encouraging and reassuring as to the future.

The experiments instituted by the initiative of the French Mission, and conducted with the aid of all the Portuguese and foreign doctors present at Oporto, prove in the most unexceptionable manner that, with energetic measures, intelligently applied, it is easy to arrest the spread of the disease in a district or in a city. These experiments were first of all directed toward the prevention of the plague among animals susceptible to it and among mankind. The international committee appointed to verify this by the President of the Portuguese Council of Ministers, affirmed that every one who would submit to the inoculation of five cubic centimetres of the anti-plague serum of the Pasteur Institute would, by such vaccination, be protected against the plague for a period of about three weeks, and that it would be of the greatest value if this vaccination were made obligatory, at least for the inhabitants of a house where a case of plague had occurred. A large number of persons were vaccinated at Oporto by this method, particularly including those who, by reason of their profession, were the most liable to contract the disease—for example, the employees of the disinfection service, the nurses and the men employed to carry away the bodies. The sole inconvenience of this method consists in the necessity of renewing the vaccinations about every twenty-five days, for the reason that the refractory state produced by the serum does not last longer.

With regard to the treatment of the sick, the actual statistics of the Plague Hospital report six deaths among sixty-three patients treated by the anti-plague serum. When one compares this mortality of ten per cent. with that of seventy or eighty per cent. which has prevailed in preceding epidemics, particularly in India, the almost perfect efficacy of the serum for the cure of the plague is demonstrated.

Before applying this treatment to patients, the French Scientific Mission wished to make experimental demonstrations on animals at the Hygienic Laboratory at Oporto. For this purpose we chose rats and monkeys; for these two species of animals are particularly susceptible to the plague virus. We commenced by determining the dose of virus necessary to kill these rats or monkeys with certainty in thirty-six hours or in five days; and after this was ascertained, we inoculated several series of animals with the same dose of the same virus. These were treated at varying stages after infection, some twenty-four hours, others nine hours, and others again two days after they had commenced to be ill. Each of these animals received varying quantities of serum, according to the state of the symptoms presented by it, and we were able to report to the International Commission that all the animals treated were perfectly cured. Under these conditions, there was no hesitation in applying the method to the sick in the hospital, and we have cause to congratulate ourselves on the results obtained.

The report of the International Commission of Oporto formally concluded by the adoption of the anti-plague serum of the Pasteur Institute, both for prevention and treatment.

We are now able, therefore, to establish with precision the precautions which it would be necessary to take if a case of plague should appear in any of the European or American cities in communication with an infected country. First of all, we know that the disease is principally propagated by rats and mice; we also know, thanks to the labors of Doctor Simond and Doctor Hankin, that the transmission of the plague from rats to human beings is most often effected by the agency of fleas. These little insects abandon rats after death to go either on other rats or on human beings, and they equally transport the infectious agent from animal to animal, and from person to person. One must, therefore, prevent, as far as possible, the importation of contaminated rats and mice, and this is the first condition to fulfill.

The Government should engage the navigation companies to use all possible measures to destroy rodents in their vessels; owners of large storehouses, especially those in which grain and cotton are deposited, should make every effort to free their buildings from these noxious and dangerous inmates. If, in spite of all precautions, a case of plague appears in a town or on a vessel, one should begin by isolating the patient in an out-building, where mosquitoes, flies and other human parasites have no access. This having been done, one should immediately insist on the vaccination by the anti-plague serum of all persons who, by their present or past relations with the patient, had been exposed to infection. The ordinary measures for disinfection will then suffice, and there is no doubt that the disease can be immediately arrested by these means.

The measures that the French Scientific Mission recommended to the sanitary authorities of Oporto were these: (1.) Isolation and the obligatory transportation of those stricken to a special hospital; (2.) compulsory vaccination of all persons who have been in contact with the sick, or who inhabit the same house; (3.) the building of temporary huts to lodge for a period of twenty days all persons who have inhabited a house where a case of plague has occurred; (4.) complete disinfection, airing and abandoning for a space of twenty days a house where a case of plague has been observed; (5.) the organization, as at Bombay, if (as almost always happens) the population conceals cases, of search committees, composed of doctors, nurses, litter bearers and police —which committees, arranged for districts, should visit twice a day all dwelling places in their quarter and satisfy themselves that no case of illness exists in them; (6.) the methodical destruction of rats and mice in the shops, houses and sewers; (7.) liberty of circulation outside the town for all persons who have been vaccinated against the plague, within a period of not less than forty-eight hours nor more than fifteen days after such vaccination; (8.) the burning of buildings of small value where many cases of the disease have occurred.

ALBERT CALMETTE.